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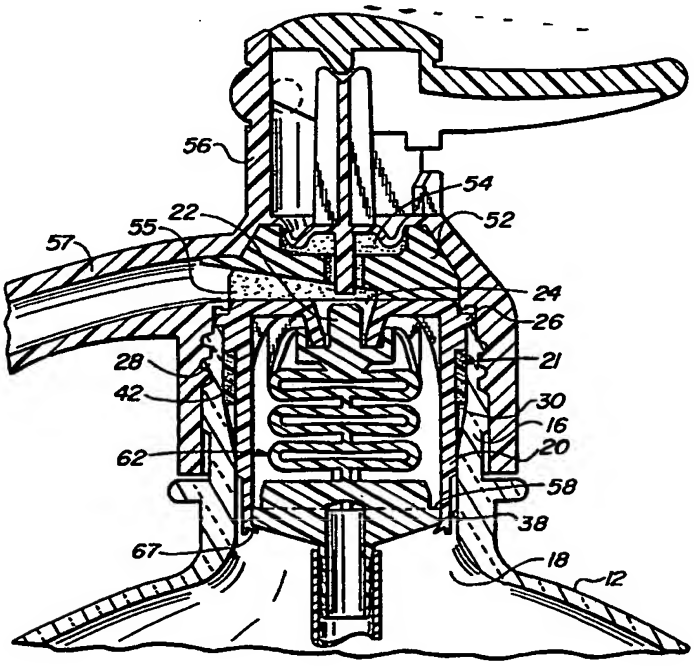

(57) Abstract

A syphon seltzer package (10) has a polyethylene terephthalate (PET) plastic bottle (12) capable of withstanding elevated pressures, with a neck (16) having an opening (18), into which a valve insert (20) is mounted. The insert (20) is held in place by an electromagnetically welded bond (21). A preform (42) of PET containing finely divided ferromagnetic material particles (44) is provided between surfaces (30 and 38) of the insert (20) and the neck (16). The preform (42) is heated with a strong electromagnetic field to form the electromagnetically welded bond (21).

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SELTZER PACKAGE WITH ELECTROMAGNETIC WELDED INSERT

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a novel package for a pressurized fluid. More particularly, it relates to such a package in which a normally closed valve is attached to a necked opening of the package with an improved bonding structure and method. Most especially, it relates to such a package in the form of a plastic syphon package for a pressurized liquid, such as seltzer water. It further relates to a novel process for making the package.

2. Description of the Prior Art

Syphon seltzer water was traditionally supplied in thick walled glass bottles with permanently attached dispensing heads, through which the bottles were filled with carbonated water at a sufficiently high pressure to provide enough force for dispensing all of the water from the bottle. For safety and economic reasons, the traditional syphon seltzer industry has virtually ceased to exist in the United States, although it has continued in certain other countries, most notably Argentina.

More recently, a plastic syphon seltzer bottle has been developed with a removable head. These packages are sold in supermarkets with a conventional twist off cap over a normally closed valve in the necked opening of the bottle. Such plastic syphon seltzer packages are described in the following commonly assigned issued U.S. Patents: U.S.

4,660,748, issued April 28, 1987 to Hagan; U.S. 4,671,436, issued June 9, 1987 to Hagan; U.S. 4,694,975, issued September 22, 1987 to Hagan; U.S. Patent 4,773,571, issued September 27, 1988 to Hagan and McIntyre.

In these packages, the normally closed valve is contained in a plastic insert that is attached to the inside wall of the necked opening of the bottle by ultrasonic bonding. The ultrasonic attachment process is described in the following commonly assigned issued U.S. patents: U.S. Patent 4,726,480 and U.S. Patent 4,726,481, both issued February 23, 1988 to Hagan. In practice, while the ultrasonic bonding process produces very reliable bonding of the valve insert in the necked opening, the ultrasonic bonding process has proved to be a limiting factor in the fabrication rate of the packages. Also, the packages resulting from these ultrasonic packages provide a seal that has proven to be commercially acceptable for the seltzer packages in ordinary supermarket distribution. However, should the packages be heated above about 100 degrees F. for a substantial period of time, relaxation of the plastic in the insert and the necked opening of the bottle can lead to loss of pressurization. This is ordinarily not a problem, even in a hot climate, because it takes a substantial length of time with the package exposed to temperatures above 100 degrees to elevate the package above that temperature because of the volume of water that must be heated to do so. However, it would be desirable to increase the ability of the package to maintain its pressure at elevated temperatures.

The use of ultrasonic bonding to fasten the normally closed valve insert in the necked opening of the bottle means that the bottle cannot be filled with seltzer water until after the insert has been fastened in place. Filling is then accomplished through the normally closed valve and syphon tube by inverting the bottle and opening the valve.

An apparatus and process suitable for filling seltzer packages with the valve insert in place is described in U.S. Patent 4,617,973, issued October 21, 1986 to Hagan and Lempert.

In contrast, conventional soft drink bottles are filled with the bottles in an upright position. While the Hagan and Lempert apparatus operates very well to fill the plastic seltzer bottles, the ability to fill the bottles in an upright position would allow the use of slightly modified conventional filling equipment and provide a much higher filling rate than the Hagan and Lempert apparatus. These limitations of the ultrasonic bonded valve insert package and its filling process have resulted in a retail price for packaged seltzer that limits sales volume because consumers tend to purchase the seltzer for special occasions, rather than as an every day beverage.

In an effort to overcome these limitations of the packages with the ultrasonically bonded insert for the normally closed valve, a package in which the normally closed valve insert is mechanically attached inside the neck of the bottle was developed. Such a package is described in pending PCT application 89/US/00599, filed February 17, 1989 in the names of Richard J. Hagan and Michael D. Clausen. The package disclosed there does not lose pressure at elevated temperatures as described above for the ultrasonic weld attached valve insert package and allows the bottle to be cold filled in a straight up position with subsequent placement of the valve insert in the neck of the bottle. However, in stress testing of this package, significant failure of the mechanical attachment is observed at pressures of about 250 pounds per square inch (p.s.i.) or higher, blowing the valve insert out of the package with considerable force. This failure mode at such a pressure constitutes a possible safety hazard, with too small a pressure difference between pressures of

up to 100 p.s.i. in typical use of the package and the minimum failure pressure. While it is quite rare, such failures also are occasionally reported with the ultrasonic bonded valve insert.

With the present commercial package, an annoying problem of drip from the spout of the dispensing head amounting to a few ml of water after each discharge of seltzer from the package is encountered. When such drips occur in the user's refrigerator after return of the package to the refrigerator, the presence of such water on other packages in the refrigerator is irritating. While the drips can be avoided by tipping the package over a glass into which the seltzer has been dispensed to remove remaining seltzer in the dispensing head, the user often forgets to exercise this precaution.

Electromagnetic welding processes for bonding plastic parts together are known in the art. For example, such a process is disclosed in a product brochure entitled "Emaweld Electromagnetic Welding System for Assembling Thermoplastic Parts," Ashland Chemical Company, 1987. As disclosed there, the electromagnetic welding process is suitable for bonding parts made from a wide variety of the same thermoplastic materials together, but is suitable for only a limited number of dissimilar thermoplastic material combinations. This is due to a perceived need to have dissimilar materials that are fairly close in melting temperatures, for both ultrasonic and electromagnetic welding. For example, the publication "Characteristics of Thermoplastics for Ultrasonic Assembly Applications," from Sonics and Materials, Inc., September 1983, teaches that the temperature differential of the materials being welded should not exceed 30 degrees F. (17 degrees C.).

It is also known to fasten thermoplastic parts together by a mechanical deformation technique, known as swaging.

However, swaging is not generally employed where parts must be bonded together to form a fluid-tight seal.

SUMMARY OF THE INVENTION

Accordingly, it is an object of this invention to provide a reduced cost pressurized beverage package with a normally closed valve insert and a removable dispensing head that is not subject to failure by blow-out of the valve insert.

It is another object of the invention to provide such a pressurized beverage package in which drips of beverage from the dispensing head are eliminated.

It is a further object of the invention to provide such a pressurized beverage package utilizing an electromagnetic welding process to bond the valve insert to the neck of the bottle.

It is still another object of the invention to provide such a pressurized beverage package having a neck and electromagnetic welded valve insert with a configuration that facilitates cold filling of the package and subsequent welding of the valve insert to the neck of the bottle.

It is a still further object of the invention to provide such a pressurized beverage package incorporating a swaged valve insert.

It is another object of the invention to provide a process for making such a pressurized beverage package which will allow easy inspection of the packages made with the process to assure that the process has been carried out properly.

The attainment of these and related objects may be achieved through use of the novel pressurized beverage package with an electromagnetic welded valve insert and process for making the package herein disclosed. A pressurized beverage package with an electromagnetic welded valve insert in accordance with this invention has a

container with a necked opening and a normally closed valve insert in the necked opening. A ring of a ferromagnetic material is positioned between the normally closed valve insert and the necked opening. There is a continuous, hermetic bond between the normally closed valve insert and the necked opening. The hermetic bond holds the normally closed valve insert within the necked opening.

The process for making the pressurized beverage package includes providing a container having a necked opening and a normally closed valve insert. The normally closed valve insert is placed in the necked opening of the container with a ring of a ferromagnetic material positioned between the normally closed valve insert and the necked opening. The ring of the ferromagnetic material is subjected to sufficient electromagnetic energy to fuse the normally closed valve insert and the necked opening together to form a continuous, hermetic bond between the normally closed valve insert and the necked opening. The hermetic bond holds the normally closed valve insert within the necked opening.

The attainment of the foregoing and related objects, advantages and features of the invention should be more readily apparent to those skilled in the art, after review of the following more detailed description of the invention, taken together with the drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an external perspective view of a syphon seltzer package in accordance with the invention.

Figure 2 is a cross-section view, taken along the line 2-2 in Figure 1.

Figure 3 is an enlarged cross-section view of a portion of Figure 2, to show detail.

Figure 4 is an exploded perspective view of a portion of the syphon seltzer package shown in Figures 1-3.

Figure 5 is a cross-section view of a portion of the syphon seltzer package of Figures 1-4, showing part of its fabrication.

Figures 6 and 6A are top plan views of a tool used in the part of the package fabrication shown in Figure 5.

Figure 7 is perspective view of a portion of the seltzer package shown in Figures 1-4.

Figure 8 is a cross-section view of an alternative embodiment of the portion of the seltzer package shown in Figure 6.

Figure 9 is a graph of results obtained with the seltzer package of Figures 1-4.

DETAILED DESCRIPTION OF THE INVENTION

Turning now to the drawings, more particularly to Figures 1 and 2, there is shown a syphon seltzer package 10 in accordance with the invention. The package 10 consists of a polyethylene terephthalate (PET) plastic bottle 12 capable of withstanding elevated pressures, typically of up to about 10 atmospheres, employed with seltzer water 14 to ensure that there is sufficient pressure remaining in the bottle 12 to discharge the last of the seltzer water 14 from the bottle 12 when it is almost empty. The bottle 12 has a neck 16 with an opening 18, into which a valve insert 20 is mounted. In accordance with this invention, the insert 20 is held in place by an electromagnetically welded bond 21. The valve insert 20 has a poppet 22, which is held in sealing engagement at central opening 24 in top 26 of the valve insert 20 until the valve formed by the insert 20 is opened. In practice, the package 10 is filled and a twist off cap (not shown), which is capable of withstanding the pressure inside the package as a safety measure, is attached by external threads 28 on the neck 16 for storage and shipping of the package 10. The consumer removes the twist off cap and replaces

it with a dispensing head 56 having a lever which is actuable to open the valve formed by the insert 20 to dispense the seltzer water 14 through a spout on the dispensing head. Further details on the construction and operation of the dispensing head are available in the above referenced issued patents and pending applications, the disclosures of which are hereby incorporated by reference herein.

Figures 2-4 show details of the electromagnetically welded bond 21. Insert 20 has a side surface 30 which is stepped at 32, 34 and 36. Inside surface 38 of neck 16 of the bottle 12 is similarly stepped at 40. A preform 42 of PET-G amorphous glycol-containing polyethylene terephthalate polymer obtained from Eastman Chemical Products, Inc., Santa Fe Springs, California, containing finely divided iron, steel or other ferromagnetic material particles 44 is provided between the surfaces 30 and 38. The preform 42 can also be PET, a polycarbonate or a copolymer polyester, also available from Eastman under the designation PCTG.

The neck 16 of the bottle 12 has a bulge 46 opposite ring portion 48. The bulge 46 engages the surface 30 to form a seal, defining a reservoir 50 below the preform 42 and above the bulge 46. The reservoir serves two functions. If the package 10 is cold filled with the seltzer 14 prior to inserting the insert 20 in the neck of the bottle 12, water droplets tend to remain on the surface 38. The preform 42 is heated with a strong electromagnetic field to form the electromagnetically welded bond, as explained more fully below. The reservoir 50 provides a space into which the water droplets can expand as they are vaporized by the heat. The reservoir 50 may also receive excess thermoplastic material from the preform 42 when the bond is formed. The seal between the bulge 46 and the surface 30 serves to isolate acetaldehyde reaction products

generated during the bonding process, thus preventing them from contaminating the inside of the bottle 12. This serves to isolate such materials completely from the seltzer water 14 inside the bottle 12. In addition to the cold filling prior to bonding the insert 20 in the neck 16, the insert can be bonded prior to filling, and an inversion fill, as disclosed in the above-referenced U.S. Patent 4,617,973, used to fill the bottle 12 with the seltzer 14.

The electromagnetic welding process subjects the preform 42 to alternating magnetic fields that cause the preform 42 to melt, by subjecting the micron-sized ferromagnetic particles 44 in the preform 42 to rapid oscillation, and fuse together the neck 16 of the bottle 12 and the valve insert 20 on either side of the preform 42. The electromagnetic welding is carried out using an induction generator which supplies an output at a frequency of about 3 to about 8 megahertz at an output power of from about 2 to about 5 kilowatts to a work coil which surrounds the neck 16 at the preform 42. A fusion time of from about 0.8 to about 4 seconds during which the generator is energized is sufficient to bond the neck 16 and the insert 20 together, depending on the density of the ferromagnetic particles in the preform 42 and whether single or multiple bottles are being bonded at a time. In practice, the ferromagnetic particles typically comprise about 15 percent by volume of the preform 42, which is equivalent to about 60 percent by weight.

The bottle 12 is formed from PET, and the insert 20 is formed from PET, PET-G, polyester copolymer, a polycarbonate or a copolymer, alloy or blend thereof, such as MAKROBLEND UT blend of polycarbonate and PET, obtainable from Mobay Plastics and Rubber Division, Pittsburgh, Pa. 15205. The preform 42 can be formed from the same materials, and the combinations for the insert 20 and the preform 42 can be mixed and matched. In practice, it has

been found that a somewhat wider latitude of bonding conditions is tolerated for the process when the preform 42 is polyester than when it is polycarbonate. The bottle 12 utilizes commercially available KODAPAK PET polyester 9663, the valve insert 20, KODAPAK PET polyester 7352, and the preform 42, KODAR PET-G copolyester 6763, all obtainable from Eastman Chemical Products, Inc., Santa Fe Springs, California 90670. If a polycarbonate insert and preform are used, commercially available LEXAN ML 4517 polycarbonate, obtainable from General Electric Plastics, Lexan Products Division, Pittsfield, MA 01201, is suitable. These PET polyesters have a melt temperature of about 485 degrees F., and the polycarbonate has a melt temperature of about 600 to about 650 degrees F. While some dissimilar materials are known to be electromagnetically weldable to bond them together, in general, those materials have similar melt temperatures. While applicant does not intend to be bound by any particular theory of operation, it is believed that, with the configuration of the neck 16 and the insert 20, the heating takes place so rapidly in the electromagnetic welding process that the melt temperatures of both materials are exceeded locally, so that the bonding will occur. During the heating step, any water vapor present on the inside surface 38 of the neck 16 is vaporized and trapped in the reservoir 50, along with any reaction products generated during the bonding process.

If a temperature indicating material that changes appearance above a desired temperature is deposited on the preform 42 prior to electromagnetic welding, the packages can be inspected for proper bonding between the insert 20 and the neck 16 of the bottle 12. Because the bottle 12 is transparent, such an appearance change can be observed through the neck 16 to verify that the bonding temperature has been reached. An example of such a temperature indicating material is TEMPILAQ, obtainable from Big Three

Industries, Inc., South Plainfield, N.J. 07080. The temperature indicating material should be deposited on surface 43 (Figure 4) of the preform 42.

Figures 2 and 7 show further details of the package 10. A drip prevention insert 52 fits into cavity 54 in head 56. The drip prevention insert essentially eliminates empty space above the valve insert 20 in which seltzer 14 can remain entrapped within the head 56 after dispensing seltzer 14 through the valve insert 20, cavity 54 and nozzle 56. The drip prevention insert 52 is formed from a suitable resilient material, such as silicone rubber, polypropylene or SANTOPRENE, obtainable from Monsanto Chemical Company, St. Louis, Missouri. The drip prevention insert 52 is configured in either a solid, uncored version as shown, or in a cored version, to reduce the quantity of resilient material required to form it, as shown by the insert 53 of Figure 8. When the cored version of the drip prevention insert is employed, it is preferably formed from polypropylene. A passage 55 leads from central opening 24 in the valve insert 20 to spout 57 on the head 56. An extension 59 of the drip prevention insert 52 extends into the spout 57 to facilitate proper positioning of the drip prevention insert 52 in the head 56. Actuating rod 61 of the head 56 extends through passage 63 in the drip prevention insert 52 to engage poppet 22 of one-piece flange, spring and poppet member 62 (see also Figure 4).

Figure 5 shows how a swaging process is used to form the valve insert 20 by fastening flange 58 to cylinder 60. One piece poppet, spring and flange member 62, formed of SANTOPRENE, is inserted in cylinder 60. A mandrel 64 is then pressed against end 66 of the cylinder 60 with sufficient force to deform the cylinder 60 over the periphery of the syphon tube flange 58. A pressure of about 300 to about 400 pounds per square inch against the end 66 by the mandrel 64 is required to produce such

deformation. Ridge 68 (Figures 3 and 4) on the syphon tube flange 58 is pressed against the cylinder 60 as a result of the deformation 67 to provide a hermetic seal between the syphon tube flange 58 and the cylinder 60. As shown in Figures 6 and 6A, the mandrel 64 can have a surface 69 that makes uniform, continuous contact with the end 66 of the cylinder 60 or a castellated surface 69A that makes discontinuous contact with the end 66 of the cylinder 60. Surface 69 of the mandrel 64 can be parallel to the end 66 as shown, or angled with respect to end 66.

Comparative tests were run on packages 10 having their inserts electromagnetically bonded against corresponding packages with ultrasonically bonded inserts. In both cases, the bottles and inserts were formed from PET, and a PET-G preform 42 was used for the electromagnetic bonding. The ultrasonic bonding was carried out as described in the above-referenced U.S. Patents 4,726,480 and 4,726,481. In these tests, the bottles were maintained at 104 degrees F. for seven days. A total of 50 electromagnetically bonded bottles and 12 ultrasonically bonded control bottles were evaluated. The results are shown in the following table and in Figure 9.

	Ultrasonic Weld n = 12	EMA Bond n = 50
Initial Vol. CO_2	Ave. = 6.4 Range = 6.2 - 6.6 Std. Dev. = 0.15	Ave. = 6.1 Range = 5.4 - 6.5 Std. Dev. = 0.30
Vol. CO_2 After 7 Days at 104°F.	Ave. = 2.6 Range = 0.85 - 5.4 Std. Dev. = 1.33	Ave. = 5.1 Range = 4.7 - 5.5 Std. Dev. = 0.2

The graph of Figure 9 compares carbonation retention of the seltzer bottles with ultrasonic welds versus electromagnetic welded bonds. The graph shows that carbonation level in the ultrasonic weld bottle falls below 4.0 volumes of CO_2, the value representing a shelf life

limit for the product, after 2 days holding at 104 degrees F. In contrast, the electromagnetic bonded bottles remain well above the shelf life limit, even after the full 7 days exposure at 104 degrees F. These results show that the use of electromagnetic bonding gives a substantial improvement to seal integrity.

It should now be readily apparent to those skilled in the art that a novel pressurized beverage package and process for making the package capable of achieving the stated objects of the invention has been provided. The invention provides a reduced cost pressurized beverage package with a normally closed valve insert and a removable dispensing head that is not subject to failure by blow-out of the valve insert. Drips of beverage from the dispensing head of the package are eliminated. The package and process utilize an electromagnetic welding process to bond the valve insert to the neck of the bottle. The package facilitates cold filling of the package and subsequent welding of the valve insert to the neck of the bottle. The package incorporates a swaged valve insert. When a temperature indicating material is applied to the preform prior to the electromagnetic welding, the process allows easy inspection of the packages made with the process to assure that the process has been carried out properly.

It should further be apparent to those skilled in the art that various changes in form and details of the invention as shown and described may be made. It is intended that such changes be included within the spirit and scope of the claims appended hereto.

WHAT IS CLAIMED IS:

1. A package for a pressurized fluid, which comprises a container having a necked opening, a normally closed valve insert in said necked opening of said container, a ring of a ferromagnetic material positioned between said normally closed valve insert and said necked opening, and a continuous, hermetic bond between said normally closed valve insert and said necked opening, said hermetic bond holding said normally closed valve insert within said necked opening.

2. The package for a pressurized fluid of Claim 1 in which said necked opening has a continuous bulge below said ring of a ferromagnetic material, said continuous bulge forming a hermetic seal between said necked opening and said normally closed valve insert, and a reservoir between said continuous, hermetic bond and said hermetic seal, said reservoir being sealed by said continuous, hermetic bond and said hermetic seal.

3. The package for a pressurized fluid of Claim 1 in which said container is formed from polyethylene terephthalate and said ring of ferromagnetic material comprises polyethylene terephthalate, polycarbonate, a copolymer, alloy or blend thereof, containing finely divided ferromagnetic material particles.

4. The package for a pressurized fluid of Claim 3 in which said normally closed valve insert includes a cylinder formed from polyethylene terephthalate, polycarbonate, a copolymer, alloy or blend thereof.

5. The package for a pressurized fluid of Claim 4 in which said normally closed valve insert includes an integrally formed flange, spring and poppet.

6. The package for a pressurized fluid of Claim 5 in which the cylinder of said normally closed valve insert includes an edge which is deformed over a periphery of the flange, fastening the cylinder and the integrally formed flange, spring and poppet together.

7. The package for a pressurized fluid of Claim 1 additionally comprising a dispensing head attached to said container over said necked opening, and a space-filling insert in said dispensing head occupying a space in said dispensing head over a top of said normally closed valve insert.

8. A package for a pressurized fluid, which comprises a container having a necked opening, a normally closed valve insert in said necked opening of said container, a dispensing head attached to said container over said necked opening, and a space-filling member in said dispensing head occupying a space in said dispensing head over a top of said normally closed valve insert.

9. The package for a pressurized fluid of Claim 5 in which said space-filling member is an insert formed from a resilient, elastomeric material or cored polypropylene.

10. A process for forming a package for a pressurized fluid, which comprises providing a container having a necked opening and a normally closed valve insert, placing the normally closed valve insert in the necked opening of the container with a ring of a ferromagnetic material positioned between the normally closed valve insert and the necked opening, and subjecting the ring of the ferromagnetic material to sufficient electromagnetic energy to fuse the normally closed valve insert and the necked opening together to form a continuous, hermetic bond between the normally

closed valve insert and the necked opening, the hermetic bond holding the normally closed valve insert within the necked opening.

11. The process for forming a package for a pressurized fluid of Claim 10 in which the container is formed from polyethylene terephthalate and the ring of ferromagnetic material comprises polyethylene terephthalate, polycarbonate, a copolymer, alloy or blend thereof, containing finely divided ferromagnetic material particles.

12. The process for forming a package for a pressurized fluid of Claim 11 in which the electromagnetic energy is supplied by an induction generator at a frequency of from about 3 to about 8 megahertz at an output power of from about 2 to about 5 kilowatts for a time of from about 0.8 to about 4 seconds.

13. The process for forming a package for a pressurized fluid of Claim 10 in which the valve insert is provided by positioning a valve insert cylinder on a syphon tube flange and mechanically deforming a portion of at least one of the valve insert cylinder and the syphon tube flange to fasten the valve insert cylinder and the syphon tube flange together.

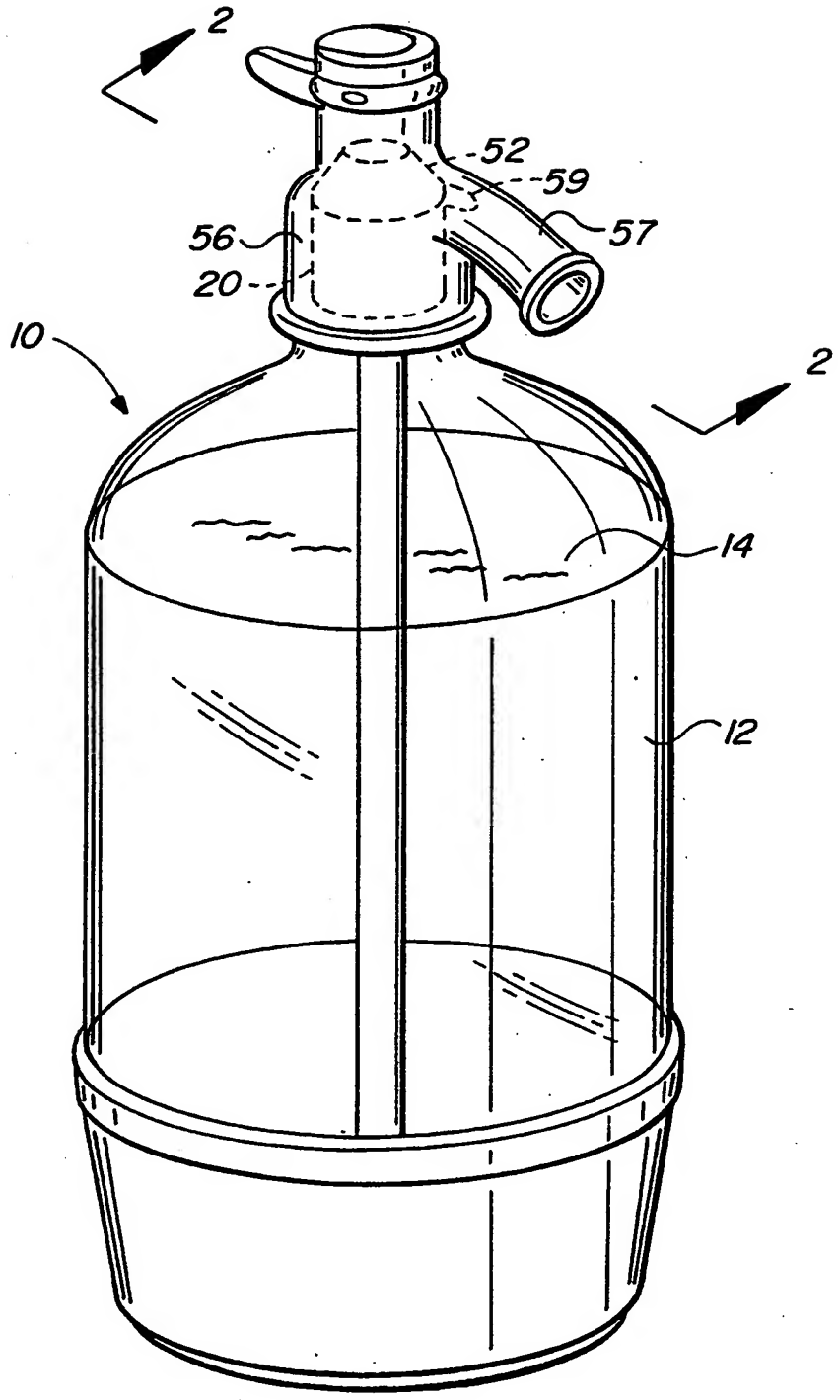

FIG._1

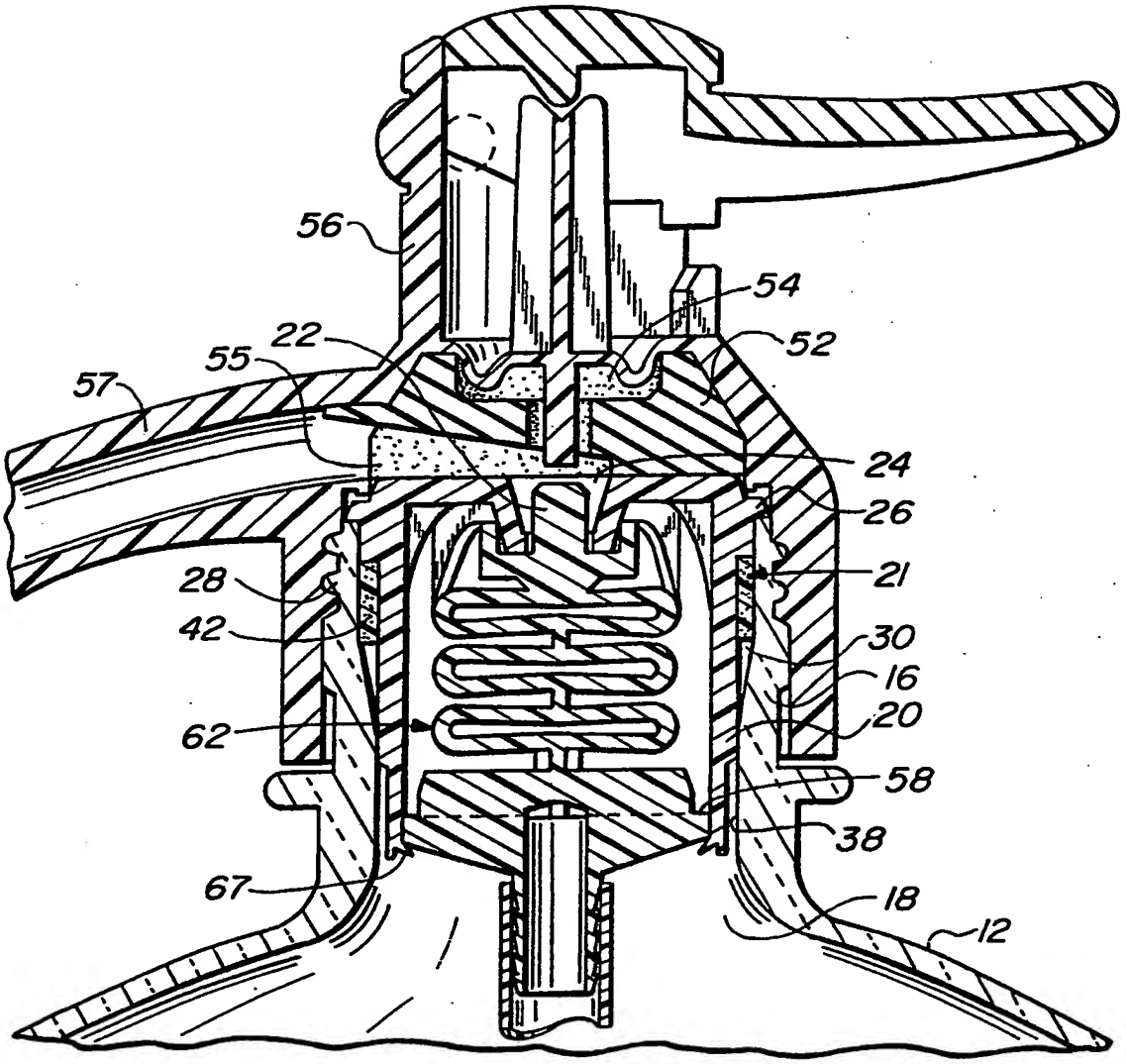

FIG._2

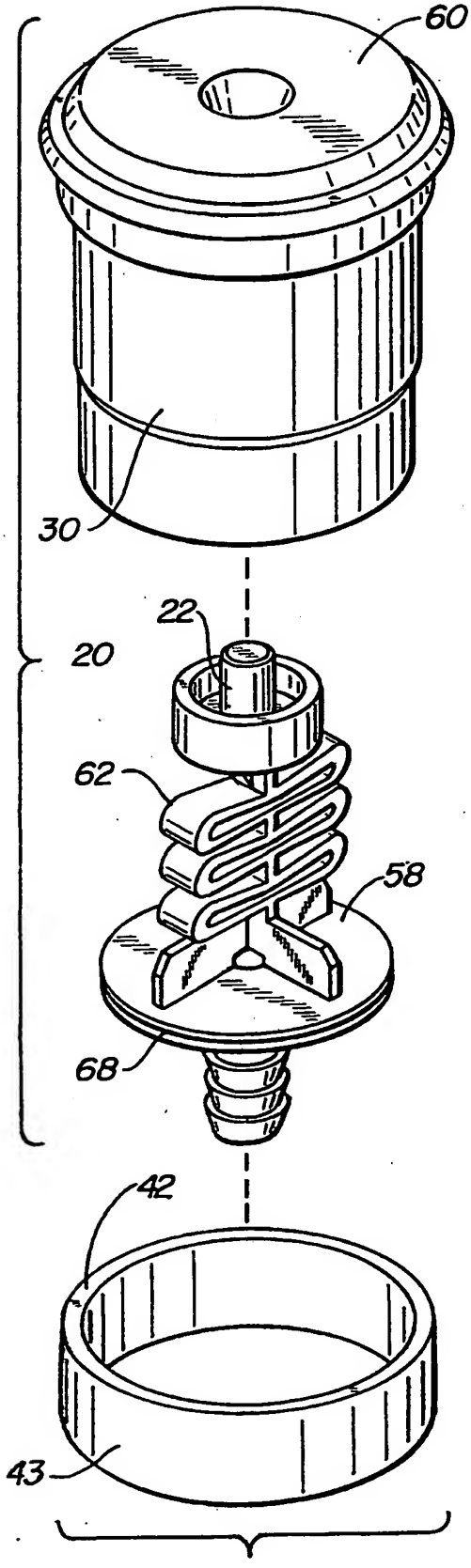
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FIG._4

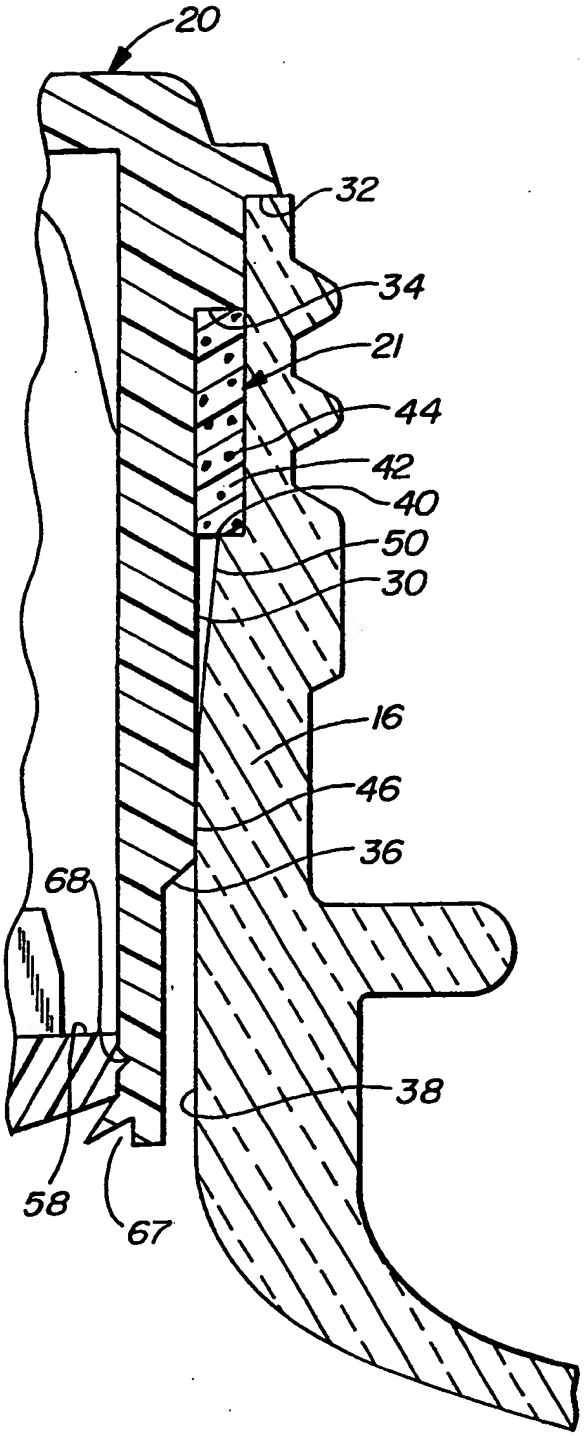
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FIG._3

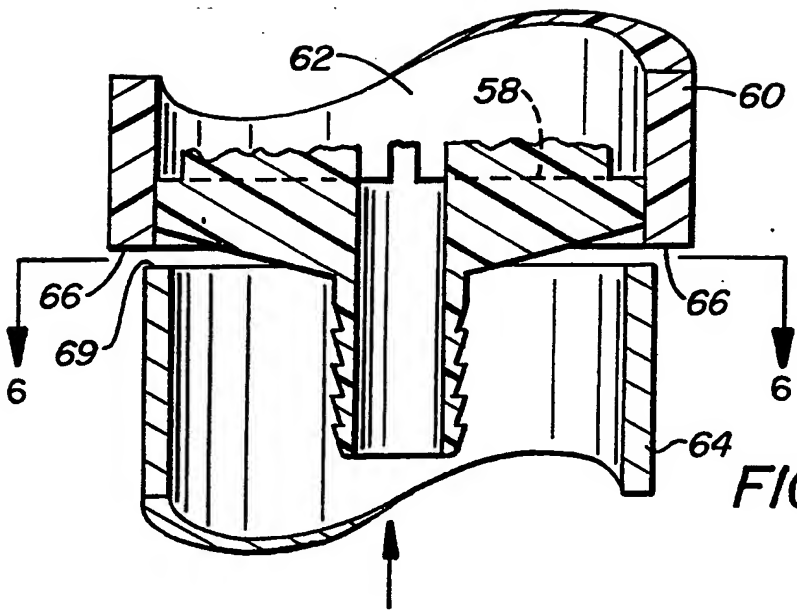

FIG._5

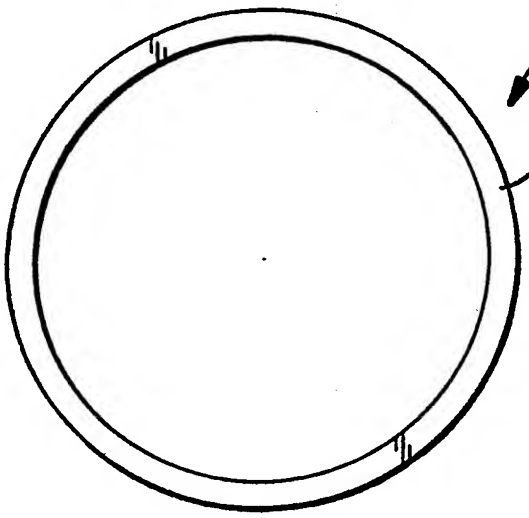

FIG._6

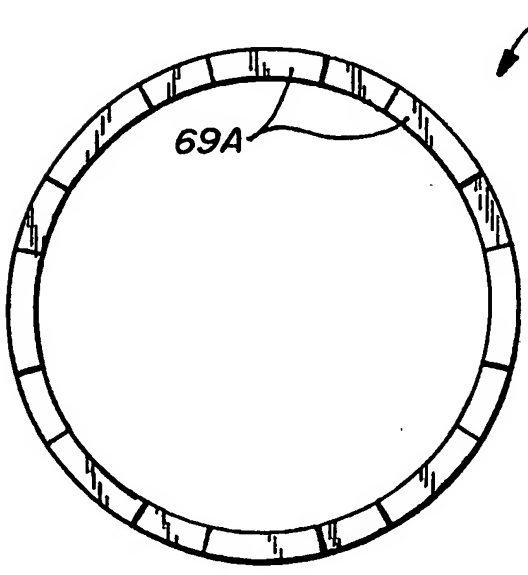

FIG._6A

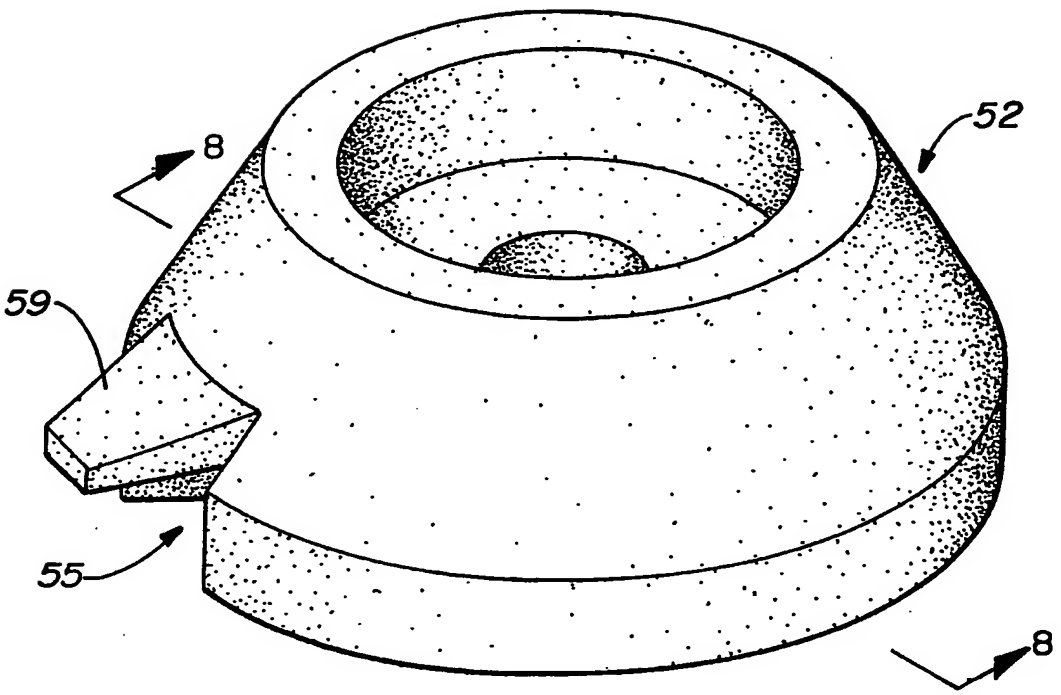

FIG._7

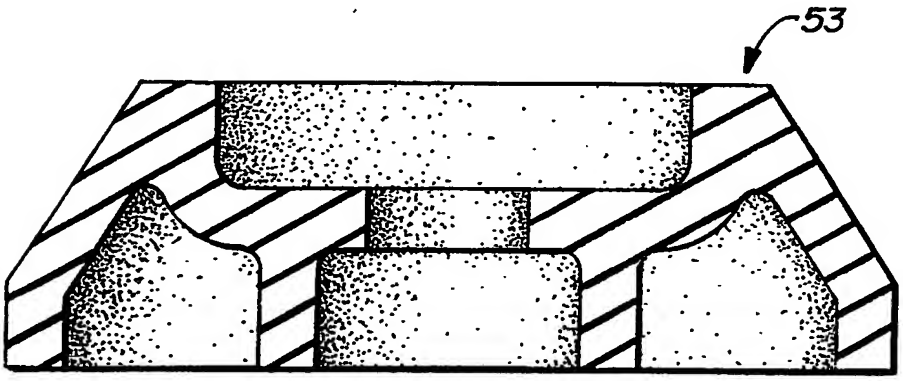

FIG._8

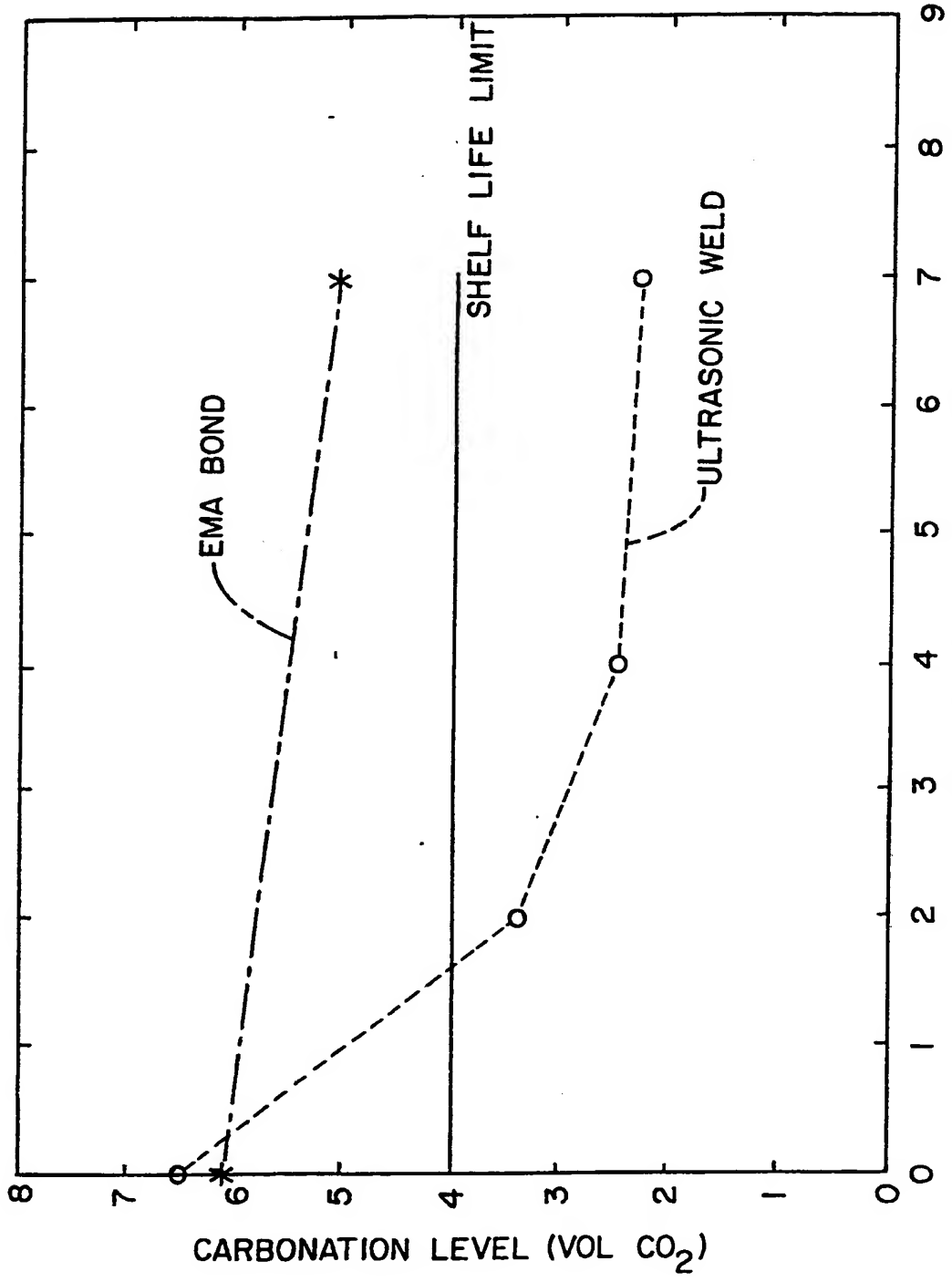
SHELF LIFE LIMIT
EMA BOND
ULTRASONIC WELD
CARBONATION LEVEL (VOL CO_2)
DAYS STORAGE AT 104 DEGREES F.
8
7
6
5
4
3
2
1
0
0
1
2
3
4
5
6
7
8
9

FIG._9

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US91/04057

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl. (5) B65D83/00; B65B 51/10; B32B 31/28

US CL 222/394,402.13; 215/4; 53/478; 156/272.4

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
US	222/394,402.13; 215/4.5; 53/478; 156/272.4; 219/10.53

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X	US,A 4,773,571 (Hagan et al) 27 September 1988, See Fig. 6	8,9
Y	US,A 4,694,975 (Hagan) 22 September 1987, See col. 6, lines 31-39 and Fig. 3.	1-7,10-13
Y	US,A 3,873,132 (Czerwiqk) 25 March 1975, See entire document	1-7,10-13
A	US,A 3,996,090 (LEATHERMAN) 07 December 1976	11,12
A	US,A 3,659,750 (LaVANGE) 02 May 1972	
A	US,A 2,839,745 (AICART) 15 April 1958	
A	US,A 2,148,047 (EPSTEIN) 21 February 1991	
A	EP,A 0,290,788 (HAGAN) 23 November 1988	
A,P	US,A 4,969,968 (Leatherman) 13 November 1990	

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
17 September 1991	03 OCT 1991
International Searching Authority	**Signature of Authorized Officer**
ISA/US	Donald T. Hajec

Form PCT/ISA/210 (second sheet) (Rev.11-87)